

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

REMARKS

Claims 1-4 and 6 have been rejected under 35 U.S.C. § 103(a). Claim 5 has been objected to as being dependent on a rejected base claim.

Claim 1 is hereby canceled.

Claim 2 has been rewritten as an independent claim. Claim 2 has been further amended to recite that the nitrogen-containing basic organic compound is at least one compound selected from the group consisting of an acrylic amine, and alicyclic amine and an aromatic amine. Support for the amendment can be found, for example, on page 2, lines 15-19, and page 3, lines 7-15, of the specification.

Claims 5 and 6 have been amended to depend solely from Claim 2.

Entry of new Claims 7-9 is respectfully requested. Support for new Claims 7 and 8 is found, for example, on page 3, lines 11-15, of the specification. Support for new Claim 9 is found, for example, on page 3, line 25, to page 4, line 4, of the specification.

Upon entry of the above amendment, claims 2-9 will be all the claims pending in the application.

Entry of the amendment to the specification, on page 3, is respectfully requested. Support for the amendment can be found, for example, on page 3, line 19, to page 4, line 4, of the specification.

Claim Rejections Under 35 U.S.C. § 103

Claims 1 and 6 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No 5,863,514 to Sasaki et al. (“Sasaki”). Claims 1-4 have also

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

been rejected under § 103(a) as allegedly being unpatentable over U.S. Patent No. 5,061,460 to Watanabe et al. (“Watanabe”). Further, claims 1-4 and 6 have been rejected under § 103(a) as allegedly being unpatentable over Sasaki in view of Watanabe. Lastly, claims 1 and 6 have been rejected under § 103(a) as allegedly being unpatentable over “Solid-State Chemistry of Thermally Induced Yellow Colouring in Synthetic Hydrous Titanium Oxide from TiCl₃,” authored by Kanezaki et al. (“Kanezaki”).

a. Rejection of claims 1 and 6 as unpatentable over Sasaki

Examiner alleges that the process of Sasaki suggests the presently claimed process of claims 1 and 6.

Claim 1 has been canceled herewith. Claim 6 has been amended to depend solely from Claim 2. Thus, Applicant respectfully requests that the § 103 rejection over Sasaki be withdrawn.

b. Rejection of claims 1-4 as unpatentable over Watanabe

Examiner alleges that the process of Watanabe suggests the presently claimed process of claims 1-4. Specifically, Examiner alleges that Watanabe suggests the instantly claimed process of mixing an acidic titanium compound, e.g., titanyl sulfate or titanium oxysulfate, with an amine and then calcining the precipitate to form titanium oxide. Examiner cites to columns 5, 13 and 14 of Watanabe.

Applicant's Response

Claim 1 has been canceled. With respect to Claims 2-4, Applicants respectfully traverse the rejection over Watanabe.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

Amended Claim 2 recites a process for producing titanium oxide comprising two steps. In step (i), an acidic solution of a titanium compound is mixed with a nitrogen-containing basic organic compound to obtain a reaction product. The nitrogen-containing basic organic compound is at least one compound selected from the group consisting of an acrylic amine, an alicyclic amine and an aromatic amine. In step (ii), the reaction product is calcined. This process produces a titanium oxide that exhibits high photocatalytic activity with visible light.

Applicant asserts that pending Claims 2 to 4, are not obvious over Watanabe, because the process described in Watanabe fails to teach or suggest calcining the reaction product recited in the Applicant's claims.

Watanabe, in column 5, describes two steps of its process. The first step involves production of titanium hydroxide by hydrolysis. The second step involves the extraction of titanium ions that were not hydrolyzed in the previous step.

In the first step, Watanabe describes that titanium hydroxide is produced by hydrolyzing a titanium-iron solution. *See* column 5, lines 9-27. Watanabe does not teach or suggest utilizing a nitrogen-containing basic organic compound in the hydrolysis step. Although Watanabe describes that the resultant insoluble titanium hydroxide may be calcined after being separated from the hydrolysis solution (*see* Watanabe Claim 1, steps (b) and (f)) or after being dehydrated and washed with an acid (*see* column 14, lines 48-49), the titanium hydroxide to be calcined in Watanabe is not a reaction product obtained by mixing an acidic solution of a titanium compound with a nitrogen-containing basic organic compound, which is step (i) of the Applicant's claimed invention.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

After the hydrolysis step, Watanabe teaches that some amounts of the titanium ion remain unhydrolyzed. *See* column 5, lines 20-24. Watanabe further teaches that the unhydrolyzed titanium ions are extracted in the next step.

In the description of the next step, Watanabe states “the titanium ion remaining in the hydrolyzed solution is extracted by contact with an organic solvent containing one or more of the species selected from the group of oxygen-containing organic solvents, alkyl amines, and alkyl aryl amines.” *See* column 5, lines 28-48. Watanabe, however, fails to teach or suggest that the product (if any) resulting from the extraction with an organic solvent is calcined.

Watanabe describes calcining a reaction product in Claim 1 and column 14.

Claim 1 of Watanabe teaches that the organic solvent is only utilized for recycling the titanium that failed to be hydrolyzed in the first step, and that the titanium hydroxide to be calcined is separated from the hydrolyzed solution before the organic solvent is used. Further, the solution which has been separated from the titanium hydroxide is brought into contact with the organic solvent in order to extract the titanium ion into the organic solvent (*see* step (c)); the organic solvent is then brought into contact with water to inversely extract the titanium from organic solution into the water (*see* step (d)) and the solution containing the inversely extracted titanium is subjected to hydrolysis (*see* step (e)). Watanabe does not teach, or suggest that one of ordinary skill in the art would be motivated, to calcine a product (if any) resulting from the extraction step with organic solvent, let alone to calcine a reaction product obtained by mixing an acidic solution of a titanium compound with a nitrogen-containing basic organic compound, as is recited in Applicant’s claims.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

In Example 7 of Watanabe, insoluble titanium hydroxide is obtained by hydrolyzing liquid containing 45.1 g of total H₂SO₄ and 9.96 g/l of titanium. *See* column 14, lines 25-52. Next, 1.1 liters of liquid taken from the inverse extraction of step (d) -- as opposed to the liquid from the extraction step with the organic solvent -- was dehydrated, washed with an acid and calcined.

Thus, there is no teaching or suggestion in Watanabe that one of ordinary skill in the art would be motivated to calcine a reaction product obtained by mixing an acidic solution of a titanium compound with a nitrogen-containing basic organic compound as in Applicant's claims.

Accordingly, reconsideration of Claims 2-4 is respectfully requested.

c. Rejection of claims 1-4 and 6 as unpatentable over Sasaki in view of Watanabe

Examiner alleges that it would have been obvious to one skilled in the art to use the amines taught by Watanabe in the process of Sasaki.

Applicant's Response

Applicant respectfully traverses this rejection because there is no motivation to combine Sasaki with Watanabe. Sasaki fails to suggest employing the alkyl amines or alkyl aryl amines described in Watanabe for producing a titanium solution.

As mentioned above, Watanabe discloses an extraction step using an organic solvent containing one or more of the species selected from the group of oxygen-containing organic solvents, alkyl amines and alkyl aryl amines.

Sasaki, on the other hand, describes producing a titanium solution by mixing and stirring a titanic acid powder with an aqueous solution of a basic substance such as an organic amine or an ammonium compound. *See* column 2, lines 35-40.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

Sasaki fails to teach selecting the amines recited in the instantly amended claims.

Furthermore, there is no motivation to combine the Sasaki with Watanabe because Watanabe describes utilizing the organic solvent that may be an alkyl amine or alkyl aryl amine for the extraction of titanium ion with an organic solvent, rather than for producing a titanium solution. As described above, Watanabe fails to teach or suggest producing its titanium hydroxide with any specific organic amine or ammonium compound. Given such a deficiency in Watanabe, one of ordinary skill in the art would find no motivation in Sasaki or Watanabe to utilize specific organic amine or ammonium compound for producing the titanium solution described in Sasaki.

In addition, the process of Sasaki is not similar to the process of Watanabe with respect to the form of the titanic acid powder that is mixed with a basic substance. Sasaki discloses mixing a titanic acid powder, rather than the solution thereof, with an aqueous solution of a basic substance such as an organic amine or an ammonium compound. Watanabe, on the other hand, discloses contacting a solution containing titanium ions, rather than a powder, with the organic solvent that may be an alkyl amine or alkyl aryl amine. Sasaki fails to provide motivation to one of ordinary skill in the art to employ the alkyl amines or alkyl aryl amines described in Watanabe in order to produce the titanium solution of Sasaki. Therefore, there is no motivation to combine Sasaki with Watanabe as described in above rejection.

Accordingly, reconsideration of this rejection is respectfully requested.

d. Rejection of claims 1 and 6 as unpatentable over Kanezaki

The Examiner alleges that the process of Kanezaki suggests the presently claimed process of claims 1 and 6.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. 09/940,479

Claim 1 has been canceled herewith. Claim 6 has been amended to depend solely from Claim 2. Thus, Applicant respectfully requests that the § 103 rejection over Kanezaki be withdrawn.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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